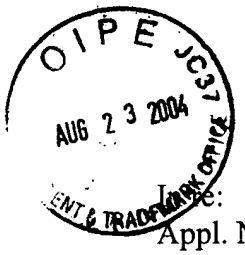
Attorney's Docket No. 38190/267789

PATENT



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor:	Edward Litwinski, Rahmatollah F. Toosky	Confirmation No.:	9631
Appl. No.:	10/631,906	Group Art Unit:	1725
Filed:	July 31, 2003	Examiner:	Lynne Renee Edmondson
For:	METHOD OF MANUFACTURING RIVETS HAVING HIGH STRENGTH AND FORMABILITY		

August 18, 2004

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

DECLARATION UNDER 37 C.F.R. § 1.131

Sir:

We, Edward Litwinski and Rahmatollah F. Toosky, hereby declare and state that:

1. We are the inventors of the claimed invention of the above-identified U.S. Patent Application Serial No. 10/631,906.

2. On or before October 23, 2001, we had reduced to practice our invention as described and claimed in the subject application, generally directed to a method of manufacturing rivets having high strength and formability. Attached as Exhibit A is a copy of a data summary sheet and four graphs as evidence of our reduction to practice before October 23, 2001. Each of the four graphs illustrates stress versus strain characteristics of two specimens prepared according to the present invention, and the data summary sheet includes the test results for all of the eight specimens. The test specimens were produced by (a) providing a plate of aluminum alloy, (b) friction stir welding a portion of the plate to form a refined grain structure in the portion of the plate, (c) cutting a strip-shaped blank from the refined portion of the plate, (d) machining the blank to form a cylindrical rod, and (d) cutting the rod at successive increments along its length to form

a plurality of cylindrical specimens. During testing, each specimen was loaded into a fixture defining a cylindrical orifice such that a portion of the specimen extended from the orifice. The extending portion was then compressed toward the fixture, thereby deforming the extending portion to form a head having a diameter greater than the rest of the specimen. A copy of the deformed specimens appears on each graph of the shear test results. (The deformed specimens are disposed in the orifices of the fixtures.) Each of the tests was conducted prior to October 23, 2001, and the four graphs were also prepared before that date. Color photographs of the same specimens are included in Appendix B. The color photographs were taken after October 23, 2001. The test results are also described on page 3 of the invention disclosure, which is attached as Exhibit C. The invention disclosure was prepared and witnessed prior to October 23, 2001. Dates, personal information, and other information not relevant to the substantiation of invention have been redacted from the copies included in Appendices A and C.

3. We hereby declare that all statements made herein of our own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application of any patent issued thereon.

Edward Litwinski

Rahmatollah F. Toosky

TOTAL P.02
PAGE 3/3 * RCVD AT 8/5/2004 5:04:44 PM [Eastern Daylight Time] * SVR:4 * DNIS:1307 * CSID:714 850 6091 * DURATION (mm-ss):01-28

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Edward Litwinski

Rahmatollah F. Toosky

CLT01/4659426v1

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Received 08/05/2004 05:06PM 05:04PM in 01:28 on line [4] for FAXCTR * Pg 3/3
AUG-05-2004 14:49 TFS AEROSPACE 714 850 6091 P.03/03

BEST AVAILABLE COPY

To: Ed Litwinski
Rahmat F. Toosky

Mail: [redacted]

Subject: Boeing Invention Disclosure No. [redacted] "Highly Deformable, High Strength Rivet Material"

**********PERSONAL INFORMATION**********

Full Name: RAHMATOLLAH F. TOOSKY

Social Security Number: [redacted] Orgn_____ M/S_____

Work Phone: [redacted] Home Phone: [redacted]

Home Address: [redacted]

City: [redacted] County: [redacted]

State: [redacted] Zip Co[redacted]

Country: [redacted] Citizenship: [redacted]

Mailing Address: _____
(if different)

Employee Type: Salaried: _____ Hourly: _____ Non-Boeing [redacted]

Company (if Non-Boeing) _____

**********ADDITIONAL INFORMATION (if known and appropriate)**********

1. Actual or projected date of first use by Boeing or others:

_____

2. Actual or projected date of publication (outside of Boeing) of concepts or other information relating to the invention:

_____

3. Useful descriptive materials (documents, drawings, test results, etc.);

See Attachment of Test DATA

_____ Copy included _____ Will furnish upon request

[redacted] Rahmat Toosky

(Date) (Signature)

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- 1 copy of completed form to U.S. Patent Administrator
- 1 copy of completed form to Patent Engineering
- 1 copy of completed form plus any attachments to outside law firm, if applicable

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SEAL BEACH, CA

To: Ed Litwinski
Rahmat F. Toosky

Mail: [redacted]

Subject: Boeing Invention Disclosure No. [redacted] "Highly Deformable, High Strength Steel Material"

**********PERSONAL INFORMATION**********

Full Name: Edward Litwinski

Social Security Number: [redacted] Orgn [redacted] M/S [redacted]

Work Phone: [redacted] Home Phone: [redacted]

Home Address: [redacted]

City: [redacted] County: [redacted]

State: [redacted] Zip Code: [redacted]

Country: [redacted] Citizenship: [redacted]

Mailing Address: [redacted]
(if different)

Employee Type: (Salaried) _____ Hourly: _____ Non-Boeing _____

Company (if Non-Boeing) _____

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[redacted]

2. Actual or projected date of publication (outside of Boeing) of concepts or other information relating to the invention:

[redacted]

3. Useful descriptive materials (documents, drawings, test results, etc.);

see attachments

_____ Copy included _____ Will furnish upon request

[redacted] Edward Litwinski

(Date) (Signature)

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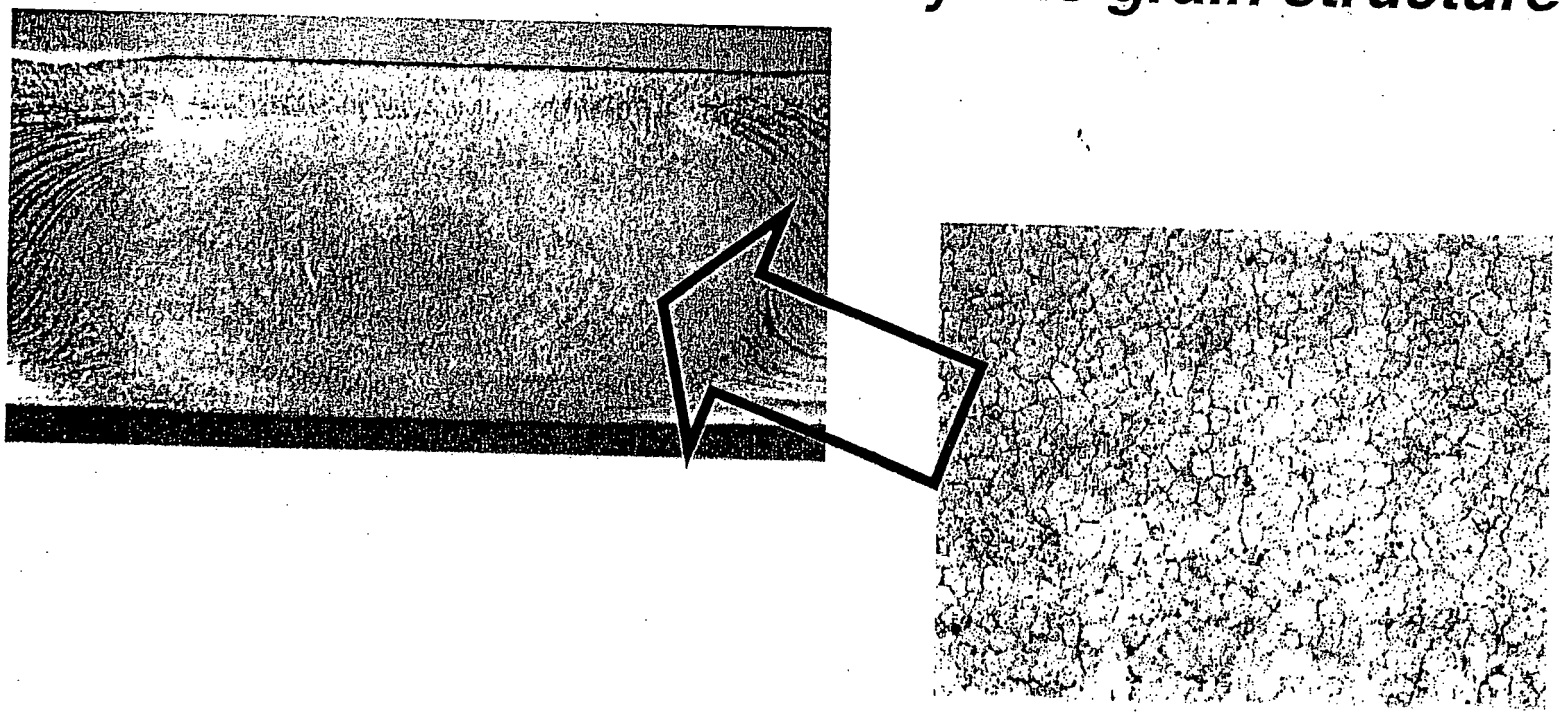
Highly Deformable, High Strength Rivets

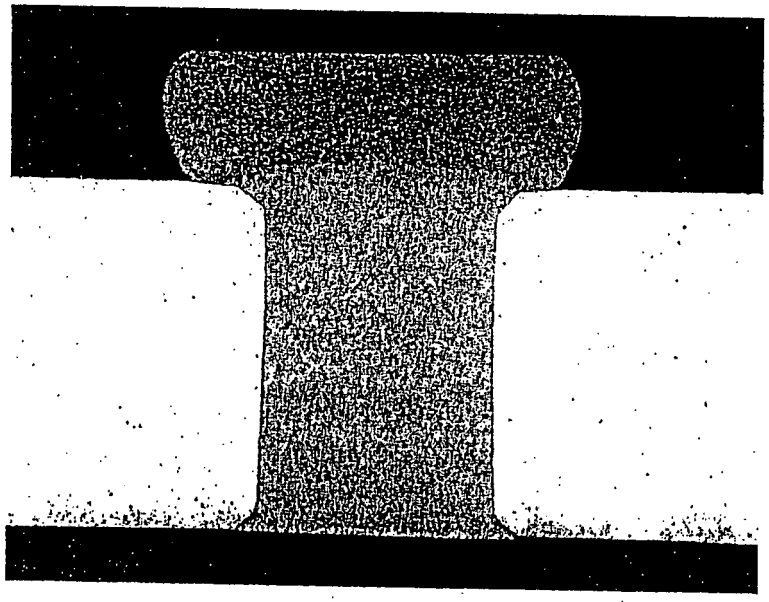
The nugget of a FSW has a very fine grain structure



Fine grain size is known to increase toughness, fatigue strength and corrosion resistance.

Conventional Rivet Technology

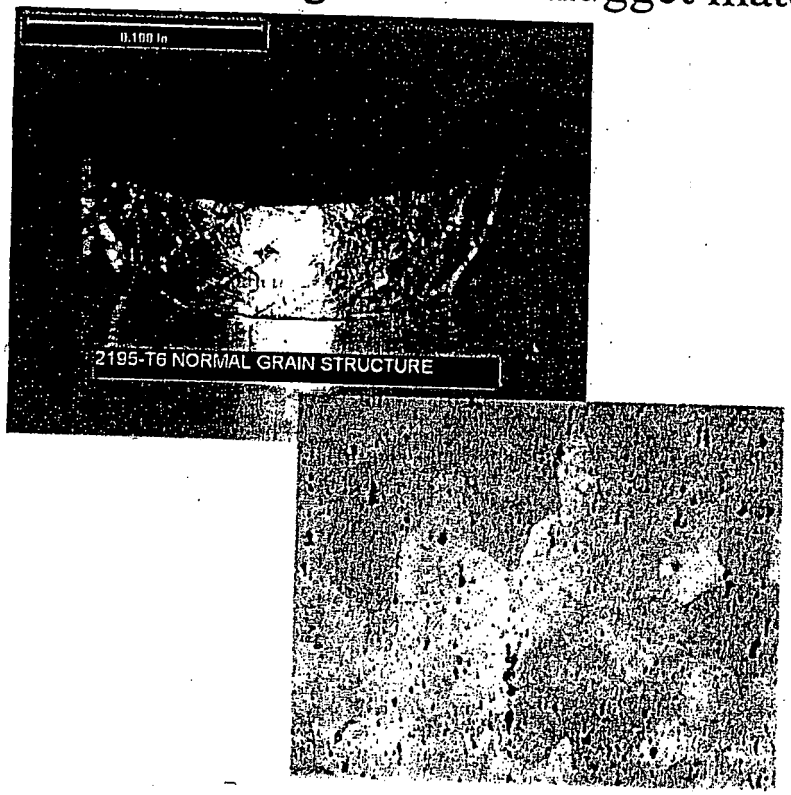
- Rivet materials had been chosen due to their ability to "upset" without cracking. The 2117-T4 alloy has been the conventional rivet alloy of choice.
- The increase in its ability to upset is related to its lack of strength



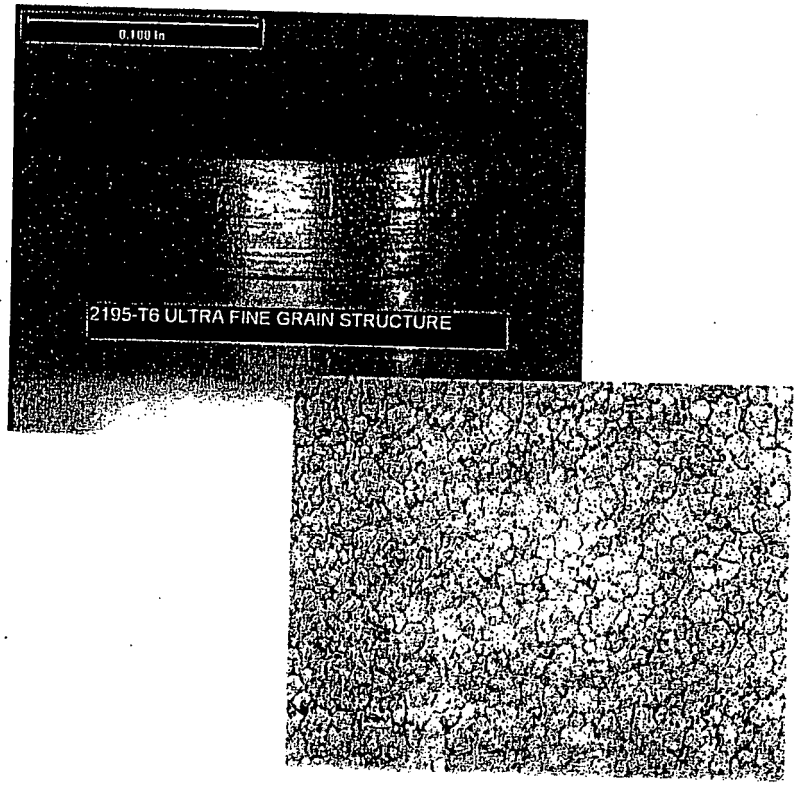
2117-T4 Material

Conventional Al-Li Alloys

- Al-Li alloys are high strength alloys with reduced weight (approximately 4.5% less). However, the higher strength does not allow the alloy to "upset" without cracking.
- The fine grain FSW nugget material can upset without cracking.



2195-T6 Material



2195-T6 (FSW) Material

Traditional Rivet Alloy Properties

- The 2195-T6 (FSW) material has better properties than conventional rivet materials.
- The process was not optimized. It is expected that with process improvements the properties could be improved to exceed conventional alloy properties with improved "upset", toughness, fatigue and corrosion properties.

Alloy Data Summary

Alloy	Weight, lbs/in3	Ult. Tensile, ksi	Yield Strength, ksi	%Elongation	Shear, ksi
2195-T6 (FSW)	0.097	Not Available	Not Available	Not Available	**38-41**
2195-T6	0.097	73	66	10	45
2017-T4	0.101	62	40	22	38
2117-T4	0.099	43	24	27	28
7050-T7	0.102	74	65	13	41
7075-T7	0.101	73	63	13	37

MECHANICAL PROPERTIES TESTING LABORATORY

SHEET 1 OF 1

DATE [redacted]

TYPE TEST: DOUBLE SHEAR

MATERIAL: SEE TABLE

T[illegible] CHARGE: [illegible]

SUBMITTER: K. TURSKY

Test RATE: 0.05"/MIN. M.S.

TESTING MACHINE:

INSTRUMENTATION: NONE

TECHNICIANS: PREPARED BY: GG

TESTED BY: GG

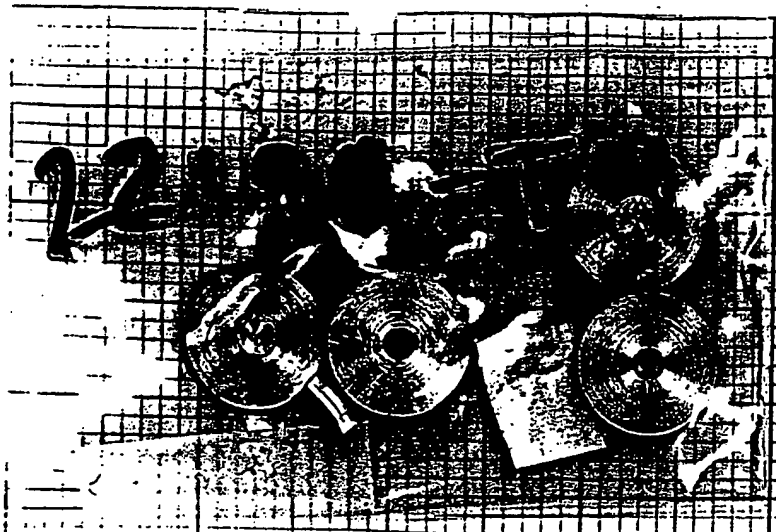
CALCULATED BY: GG

NO.	CODE	DIA. (IN.)	ULT. DBL. SHEAR LOAD (LBS.)		SHEAR STRESS PSI					
1	2219-T6	0.1555	1103		29040					
2	"	0.1570	1105		28539					
3	2195-T4	0.1555	1320		34755					
4	"	0.1555	1439		37886					
5	2195-T6	0.1555	1485		39093					
6	"	0.1555	1559		41046					
7	2219-T4	0.1570	1137		29155					
	"	0.1575	1160		29770					

DATA AND RESULTS CHECKED

T. T. Sullivan

DATE [redacted]



Ray Teasley [redacted]

.025"

.500

2219-T4

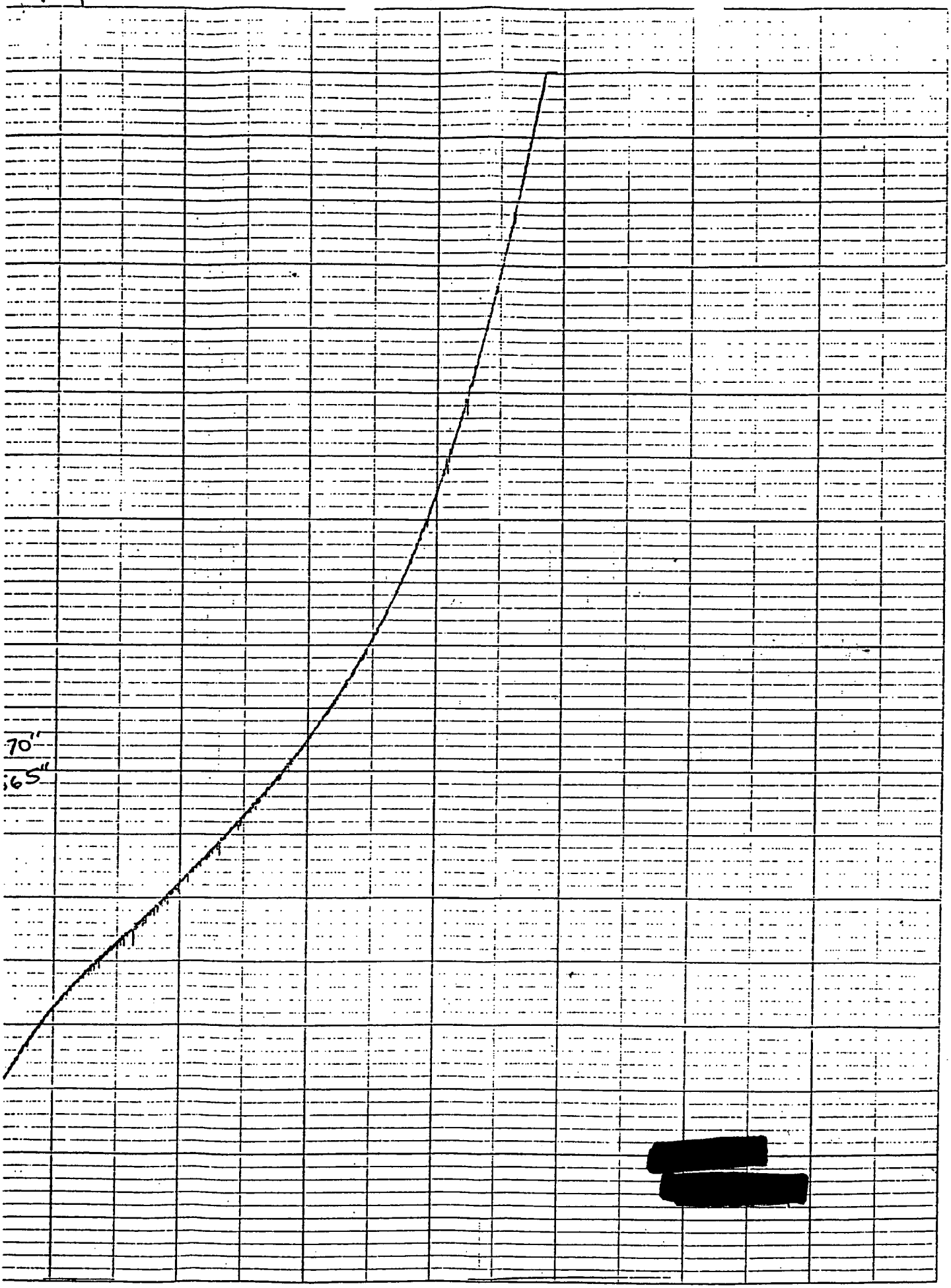
#1 L=.3110"

T=.1575"

500 lbs/in

L T

.025"/in

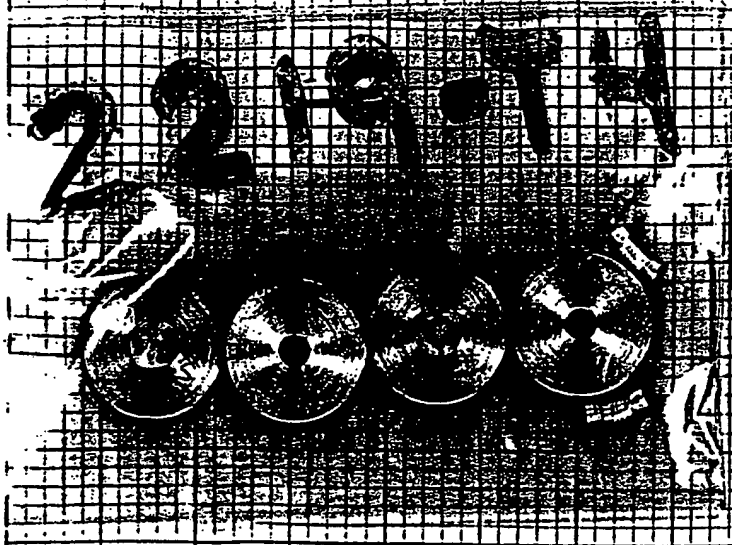

70"
65"

2219-T4

Ray Toosky

[redacted]

NO. XY 1101 SPH



.025"

500 Lbs.

5000

2500

2000

1500

1000

500

NO 1

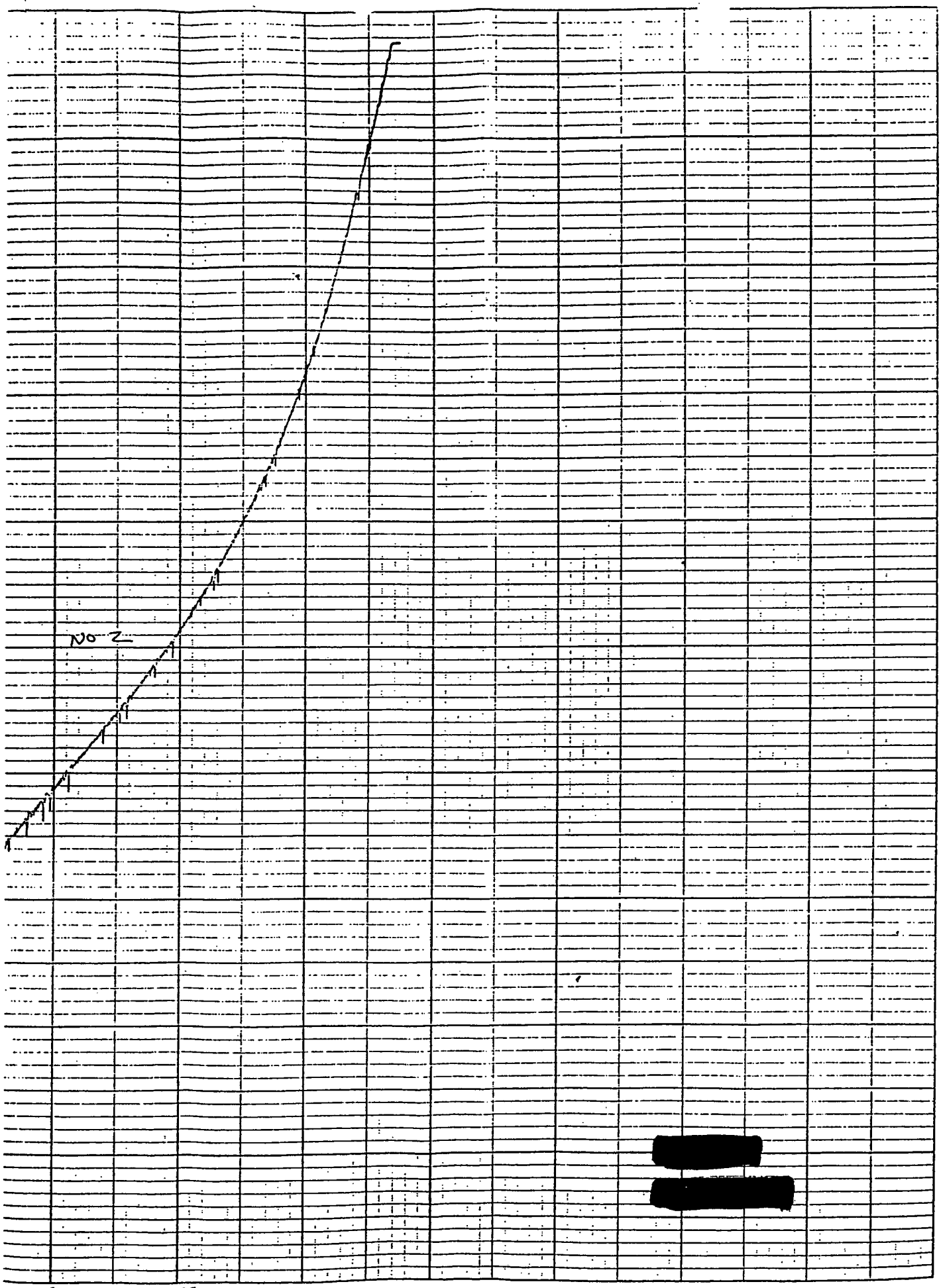
NO 2

L = .314"

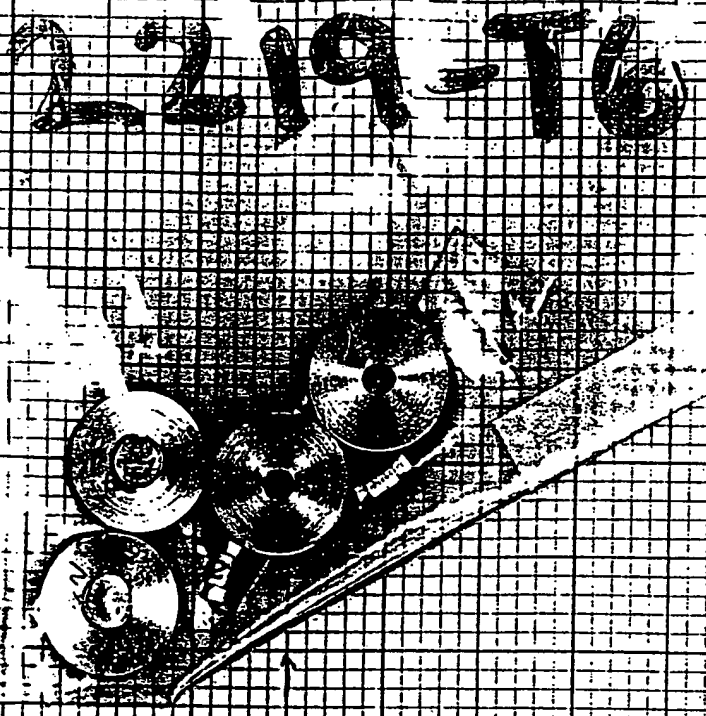
T = .155"

#1 2195-T4

#2 2195-T4 .025


No 2
.050
.075
.100
.025"/in.

2219-T6



Ray To [redacted]

500

.025"

2219-T6

L = .3175"

T = .156"

500 Lbs/in.

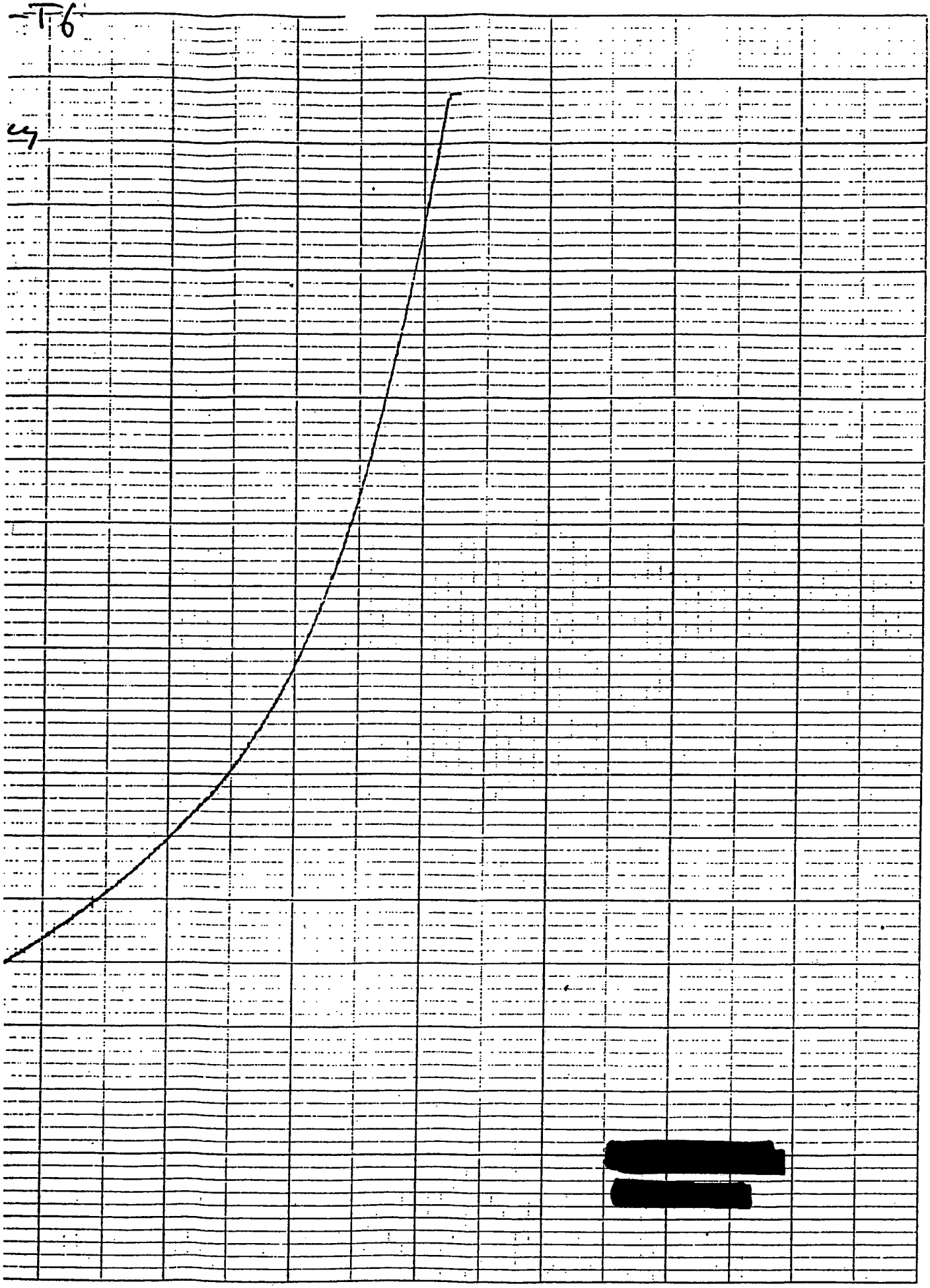
#2

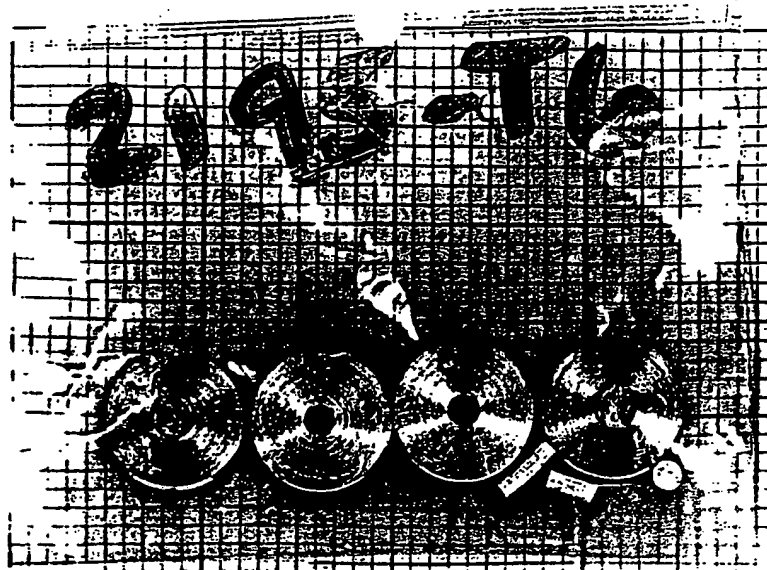
L = .3160"

T = .156"

.025"/in.

NO. XY 1101-SP"





2195-T6

Ron Tooby

[redacted]

.025"

500 lbs.

#1
L = .3165"
T = .1545"

#2
L = .3150"
T = .1550"

1500

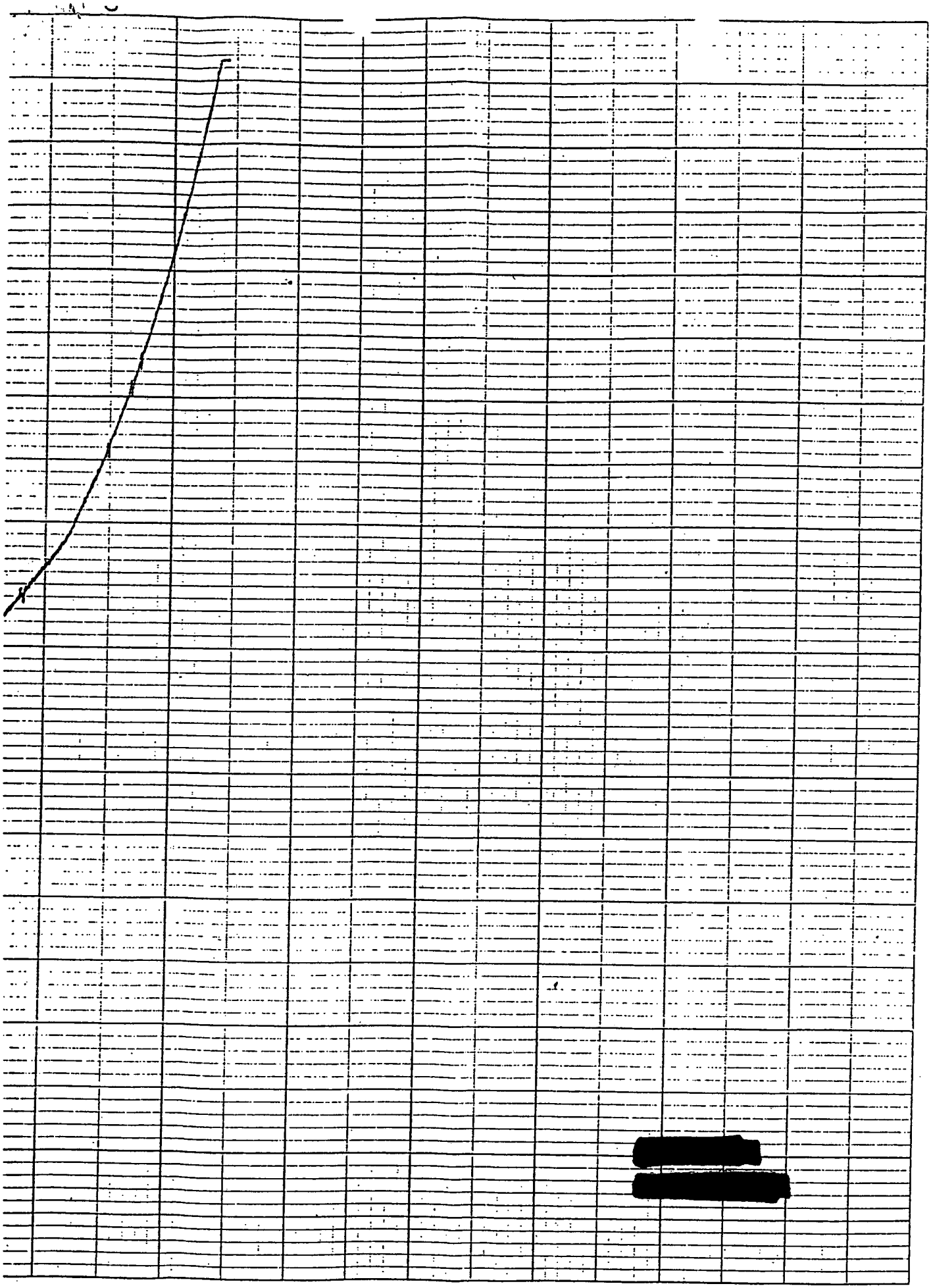
1000

500

#1
2195-T6

2195-T6

.025



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